

REMARKS

The Examiner's Action mailed on July 26, 2005, has been received and its contents carefully considered. Additionally attached to this Amendment is a Petition for a Two-month Extension of Time, extending the period for response to December 26, 2005.

In this Amendment, Applicant has editorially amended the title of the invention, the specification, and has amended independent claim 1 to include the subject matter of claim 8. Further, claim 8 has been canceled. Claim 1 is the independent claim, and claims 1-7 and 9 remain pending in the application. For at least the following reasons, it is submitted that this application is in condition for allowance.

The Examiner has objected to the title of the invention as not being descriptive. In response, the title has been amended in a manner that is clearly indicative of the invention to which the claims are directed. It is requested that this objection be withdrawn.

The Examiner has rejected claims 1-9 as being anticipated by *Hsu et al.* (USP 6,143,645). Because claim 8 has been canceled, and the subject matter recited therein incorporated into independent claim 1, Applicant will treat this rejection as pertaining only to claims 1-7 and 9. It is submitted that these claims are *prima facie* patentably distinguishable over the cited reference for at least the following reasons.

It is well settled that a reference may anticipate a claim within the purview of 35 U.S.C. § 102 only if all the features and all the relationships recited in the

claim are taught by the referenced structure either by clear disclosure or under the principle of inherency.

Applicant's independent claim 1 is directed to a method of making a semiconductor device which has a semiconductor substrate with a contact hole that is filled by an aluminum-containing thin film. A silicon-containing thin film is formed in a region having a predetermined area, and which includes an inner surface of the contact hole. The aluminum-containing thin film is formed on the surface of the semiconductor substrate on which the silicon-containing thin film is formed. The semiconductor substrate, on which the aluminum-containing thin film is formed, is heated, causing silicon to diffuse with respect to aluminum. Moreover, this claim recites that the semiconductor substrate is provided with a plurality of cells, each containing the contact hole. Moreover, the ratio of the amount of silicon contained in the silicon-containing thin film formed in the region, to an amount of aluminum supplied to a unit cell, is not less than 0.1% and not more than 2% by atomic ratio. The advantages of this claimed invention are discussed throughout Applicant's specification, for example, page 9, line 25 through page 10, line 5. This claimed invention is not disclosed (nor suggested) by the cited reference.

Hsu et al. disclose a method of filling a high-aspect-ratio via with a metallization layer. In particular, this reference discloses that prior to the *Hsu et al.* invention, aluminum alloys were known, which include a small fraction of silicon, e.g. 1% atomic, which reduced the aluminum's tendency to dissolve silicon. However, this reference discloses that the use of silicon alloys has several problems (see column 1, line 59 through column 2, line 4). This patent attempted

to overcome the problems associated with the prior art by forming a silicon-rich wetting agent 500 on a surface of a dielectric layer 210, and on sidewalls of a via hole 202 which is etched in the dielectric layer 210. This reference also discloses forming a thin diffusion barrier layer 510 on the surface of the wetting agent 500, which prevents diffusion of the wetting agent 500 into a metal alloy layer 520 which is formed over the wetting agent 500. This reference also discloses that in one embodiment, the aluminum alloy 520 is re-flowed into the via 202 using a sputtering operation at elevated temperatures.

The Examiner's Action states that *Hsu et al.* disclose heating a semiconductor substrate to such a temperature so as to cause silicon to diffuse with respect to aluminum, and refers to column 4, lines 15-30 and to Figure 3 of the *Hsu et al.* patent. However, column 4, lines 15-30 do not disclose that the substrate 200 is heated, as would be required by Applicant's independent claim 1. Instead, this passage only discloses that the aluminum alloy is re-flowed into the cavity 202 by sputtering at an elevated temperature. There is absolutely no disclosure from this reference that the sputtering at an elevated temperature inherently or explicitly requires or results in the semiconductor substrate being heated, much less to such a temperature as to cause silicon to diffuse with respect to aluminum, as recited by claim 1.

Moreover, with respect to original dependent claim 8, the subject matter of which is now incorporated into independent claim 1, the Examiner's Action states that *Hsu et al.* disclose that the semiconductor substrate is provided with several cells, each including a contact hole. However, Applicant has studied the reference, and has been unable to find any disclosure that the disclosed device

includes a plurality of cells, as recited by Applicant's independent claim 1. In fact, Applicant has not been able to find any disclosure that there is even one cell.

Moreover, the Examiner's Action refers to Figure 3 in support of the contention that the cited reference discloses Applicant's claimed ratio as originally recited within claim 8. However, it is noted that Figure 3 makes no reference to the ratios whatsoever. Moreover, the only disclosure from this reference of atomic ratios is discussed in column 2, lines 1-24, where the prior art configurations are discussed. However, the Examiner is respectfully reminded that in order to establish a *prima facie* case of anticipation, a single structure of the prior art device must either explicitly or inherently disclose all of Applicant's claimed features. That is, in establishing a *prima facie* case of anticipation, it is impermissible to combine the teachings from the prior art disclosure discussed in the background of the invention of the cited reference with the disclosure directed to the embodiments discussed in the detailed description of the invention, as the Examiner is apparently doing.

Moreover, it is further noted that the cited reference does not disclose Applicant's claimed ratio of the amount of silicon contained in the silicon-containing thin film which is formed in the region, to the amount of aluminum supplied to a unit cell, as recited by Applicant's independent claim 1. That is, Applicant's claimed semiconductor substrate may include a portion that is provided with no cells and further, silicon may not be present on such a portion in accordance with Applicant's invention. Therefore, the ratio recited in Applicant's independent claim 1 is not necessarily equal to a ratio of an entire amount of silicon supplied to the semiconductor substrate to an entire amount of aluminum

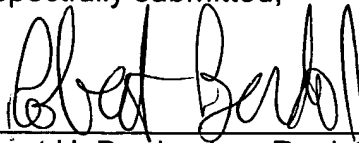
supplied to the semiconductor substrate. Stated alternatively, it is noted that the background disclosure of the cited reference teaches that the entire aluminum layer is alloyed with silicon, which does not necessarily result in Applicant's claimed ratio. As such, it is submitted that the Examiner's Action has failed to establish a *prima facie* case of anticipation. It is therefore requested that these claims be allowed and that these rejections be withdrawn.

It is submitted that this application is in condition for allowance. Such action and the passing of this case to issue are requested.

Should the Examiner feel that a conference would help to expedite the prosecution of this application, the Examiner is hereby invited to contact the undersigned counsel to arrange for such an interview.

Should the remittance be accidentally missing or insufficient, the Commissioner is hereby authorized to charge the fee to our Deposit Account No. 18-0002, and advise us accordingly.

Respectfully submitted,



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Date

Robert H. Berdo, Jr. – Registration No. 38,075
RABIN & BERDO, PC – Customer No. 23995
Facsimile: 202-408-0924; 202-408-5297
Telephone: 202-371-8976

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